

**Factoring the Findings of the Groundwater Remedial
Investigation into Remedial Action Decision Making**

**Ringwood Mines/Landfill Superfund Site
Ringwood, Passaic County, New Jersey**

Submitted to:

**The National Remedy Review Board
U.S. Environmental Protection Agency**

Submitted by:

**Mayor and Council
Borough of Ringwood**

May 28, 2013

1.0 INTRODUCTION

This submission is made on behalf of the Borough of Ringwood (Borough), through its duly elected members of the municipal Council, as the host municipality, property owner and potentially responsible party (PRP). Although the Ringwood Mines/Landfill Superfund Site (Site) is located in Upper Ringwood, the Site and consideration of the appropriate remedy affect all of the 12,000 Ringwood residents who are represented by the Council. Mayor/Council member Linda Schaefer and Deputy Mayor/Council member John Speer are also members of the Ringwood Community Advisory Group (CAG).

The Site includes approximately 500 acres within Upper Ringwood and encompasses moderately rugged forested areas, open areas of overgrown vegetation, abandoned mine shafts and surface pits, the municipal recycling center, the Ringwood Borough Garage, several residential properties, and a small portion of the Ringwood State Park which is located north and east of the Site. A map showing the location of the Site in reference to surrounding surface waters, the Wanaque Reservoir, and the Borough's municipal drinking water wells is provided as Figure 1. Ringwood's ownership came through a series of conveyances of various portions of the Site, all of which began with conveyances from Ringwood Realty Corporation, a subsidiary of the Ford Motor Company.

In 2012, it was the Borough's understanding that the United States Environmental Protection Agency (USEPA) intended to bring this Site to the National Remedy Review Board (NRRB) as part of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process. On May 18, 2012, the Borough prepared and submitted a stakeholder paper entitled "Overview of Site Conditions and Feasible Remedial Action Alternatives for Protection of Human Health and the Environment at the Ringwood Mines/Landfill Site: Peter's Mine Pit Area, O'Connor Disposal Area, and Cannon Mine Pit Area, Ringwood, Passaic County, New Jersey". A copy of the Borough's 2012 submission is attached for reference.

The USEPA ultimately did not meet with the NRRB in 2012 and, in the interim, as further discussed in this paper; a significant amount of supplemental investigation of groundwater and surface water was conducted by the environmental consultant, ARCADIS, for Ford Motor Company (Ford) throughout 2012. A Draft Site-Related Groundwater Remedial Investigation (RI) Report was prepared and submitted to the agencies by ARCADIS in January 2013 detailing the findings of the supplemental RI and incorporating these new data into an updated Conceptual Site Model for the Site (Arcadis Figure 34) and individual Conceptual Site Models for each of the 3 land ACs, including the PMP Area (Arcadis Figure 33), the CMP Area (Arcadis Figure 28), and the OCDA (Arcadis Figure 25).

Given that a significant amount of new groundwater and surface water data have been generated since the Borough submitted its May 18, 2012 paper and USEPA now intends to meet with the NRRB in June or July 2013, the Borough was advised that any additional stakeholder submissions must be made by May 28, 2013 for consideration at the June or July 2013 NRRB meeting. In anticipation of submitting a stakeholder letter on behalf of Ringwood, Mayor Schaefer and the Council wanted to solicit input from all Ringwood residents, including the CAG members who are Upper Ringwood residents and who have expressed their views during CAG meetings.

On May 15, 2013, the Borough published a notice for a special Council meeting for May 23, 2013 at which the Borough's professionals provided an overview of the findings of the 2012 supplemental RI of groundwater and surface water quality at the Site as detailed in the Draft Site-Related Groundwater RI Report dated January 2013 from the Borough's perspective as the host municipality. This forum enabled the public, as well as the Mayor and Council, to ask questions generally about the Site, including groundwater and surface water quality, and express their concerns or opinions, for consideration by the Council. About 15 members of the public, including Borough residents, attended this meeting and three Borough residents asked questions and/or made comments. The technical advisor to the Community Action Group (CAG) for the Site also made comments. Questions were

also asked by the Mayor and several Councilmen. Following EXCEL's presentation and public comments and discussion, the Mayor and Council authorized the preparation and submission of this paper to the NRRB via Borough Resolution Number 2013-168 which is attached.






This submission incorporates the public comments made by the Borough residents and by the Council with the best interests of the entire Borough of Ringwood community in mind. The balance of this submission provides an overview of the findings of the Draft Site-Related Groundwater RI Report as presented by the Borough's environmental consultant, EXCEL Environmental Resources, Inc. (EXCEL), and discussed at the May 23, 2013 Public Meeting conducted by the Borough, including groundwater and surface water quality associated with each land AC, placed into perspective with respect to the low level benzene and intermittent arsenic and lead exceedances and how these data factor into the Conceptual Site Model and remedial action decision-making for the three land ACs and Site-related groundwater.

2.0 DUAL ROLE AS HOST MUNICIPALITY/POTENTIALLY RESPONSIBLE PARTY




The Borough owns the majority of the Site creating its dual role as the host municipality and a Potential Responsible Party (PRP) under CERCLA. The Borough's first priority is to ensure the Site is thoroughly investigated and properly remediated for the protection of human health and the environment both in the short and long term. The Borough and its residents have suffered for many years the long-lasting negative impacts caused by the stigma of this Superfund Site which will dissipate only after the Site is remediated and removed from the National Priorities List (NPL). Timeliness of the remaining work is a major concern and therefore, closure of the Site and finality are also of paramount interest to the Borough.

3.0 BOROUGH'S OBJECTIVES

The Borough's primary objective is to support the USEPA's selection of a remedy for the 3 land ACs and Site-related groundwater at the Site which is:

-  Protective of human health, environment, community and residents
-  Technically justified and appropriate for the documented risks
-  Can be implemented in a timely manner
-  Does not cause further risk or harm to the environment, residents, existing infrastructure, or the community
-  Least disruption/disturbance to the community and its residents

The Borough wants to be assured of the adequacy of the investigation as:

-  The Borough is the only party to remain after the Site is closed and de-listed
-  The Borough owns most of the property that is the subject of this submittal
-  Leads to the most appropriate remedies to be selected for each of the areas of concern, including the 3 land areas and Site-related groundwater

4.0 THE BOROUGH'S REMEDIAL ACTION ALTERNATIVE EVALUATION PROCESS

In consideration of the proposed feasible remedial action alternatives for the 3 land ACs, in addition to ensuring a thorough investigation and appropriate remediation of the Site, the Borough is concerned about how long it will take to implement and complete the field activities associated with the selected remedies. First, the Borough must consider whether or not a remedial action alternative is protective of human health and the environment. For those which are, next we must evaluate each alternative by comparing the relative "cost" (which include risks, monetary, and time) in the context of the level of protection and effectiveness of a given alternative.

Finally, if the choices are narrowed down to Excavation/Disposal and construction of an Engineered Cap with Institutional Controls, we must compare the cost of implementation (as defined above) to what, if any, the added level of protection and effectiveness an excavation remedy would provide over capping given the minimal risks posed by the existing “pre-remediation” conditions as documented by the extensive investigations and risk assessments conducted at the Site, including the recently completed RI for groundwater (ARCADIS, 2012a-2012k and 2013a).

The Borough has consulted with its environmental expert EXCEL as well as with the USEPA, New Jersey Department of Environmental Protection (NJDEP), Ford, and Ford’s environmental consultant, ARCADIS, and the Technical Advisor for the CAG and has concluded that the two remedies, or variations thereof, that are likely being considered by USEPA and being presented to the NRRB are Excavation/Disposal and use of Engineering Controls in the form of an Engineered Cap with Institutional Controls in the form of a Deed Notice. At the conclusion of the NRRB process, the Borough will further evaluate the remedial action alternatives after considering the technical recommendations by the NRRB, USEPA Region 2, NJDEP, EXCEL and community/resident concerns.

5.0 RETENTION OF THE BOROUGH’S ENVIRONMENTAL EXPERT

EXCEL was retained by the Borough to provide expert technical and regulatory consultation for review and evaluation of the Remedial Investigation (RI), Risk Assessment, and Feasibility Study (FS) activities that have been recently conducted to address the three land ACs and Site-Related Groundwater at the Site. EXCEL’s role has been to provide input regarding the technical and regulatory adequacy, appropriateness, and thoroughness of the work and resulting data generation and interpretation in an effort to ensure that the approach to characterization of the Site and the evaluation of feasible Remedial Action alternatives is sound, accurate, reliable, and defensible now and in the future.

Over the past two and one half years, the Borough has worked closely with Ford as directed by the USEPA and in compliance with the Unilateral Order issued by USEPA to the Borough in July 2011. EXCEL has worked closely with Ford’s environmental consultant, ARCADIS, and has been actively participating in the finalization of documents recently submitted by ARCADIS on behalf of Ford for agency review. These documents include the recently revised RI Reports, Baseline Human Health Risk Assessment (BHHRA) Reports, Screening Level Ecological Risk Assessment (SLERA) Reports, and the Draft FS Reports for Peters Mine Pit, Cannon Mine Pit and the O’Connor Disposal Area, and, most recently, the Draft Site-Related Groundwater RI Report.

It is important to recognize that EXCEL has conducted their own independent review and comment on the work with no pre-conceived notion with respect to the outcome of their evaluation. In fact, EXCEL has provided constructive and, when deemed warranted, critical feedback to Ford and ARCADIS which has often resulted in ARCADIS re-evaluating, or more closely examining, certain data and their meaningfulness with respect to the Conceptual Site Model for the Site.

For example, with respect to the Site-Related Groundwater AC, EXCEL’s input resulted in the recommendation to conduct additional investigative field work to refine and more fully and clearly develop the groundwater component of the Conceptual Site Model. With agency approval of the work scope, the Supplemental RI activities for the Site-Related Groundwater AC were completed in late 2012, the data were evaluated and interpreted by the consultants for Ford and the Borough, and the Draft Site-Related Groundwater RI Report was issued to the agencies in January 2013.

5.1 Separation of Groundwater from the Three Land ACs

One of the issues raised by EXCEL early on in their role as the Borough's environmental expert which remains a concern through to this date is that, although groundwater data has been generated during the RI conducted within each of the three land ACs, the USEPA decided to separate groundwater at the Site into a separate AC referred to as "Site-Related Groundwater". The work scope and schedule of activities for the Site-Related Groundwater AC have progressed on a separate track from the three land ACs that are the subject of this submission. Since the schedule for conducting RI and Risk Assessment and FS activities and issuing the reports for the three land ACs had been greatly accelerated beyond the timeframes outlined in Ford's 2010 Administrative Order on Consent (AOC) with USEPA, up until 2012, the schedule for implementation of the RI for the Site-Related Groundwater AC was lagging behind.

Following USEPA's approval of the Supplemental Work Plan for Site-Related Groundwater in May/June 2012, the extensive Supplemental RI was implemented and a significant amount of additional investigation was generated with respect to groundwater and surface water quality at the Site. The work scope and findings are detailed in the Draft Site-Related Groundwater RI Report dated January 2013 thus effectively bringing the status of the RI for Site-Related Groundwater in line with the status of the RI for the 3 land ACs.

Although the Draft Site-Related Groundwater RI Report has been issued and was reviewed by USEPA, the USGS, the NJDEP and NJGS as well as the CAG thus bridging the gap that previously existed between the status of the RI for the 3 land ACs and the RI for Site-related groundwater, the net result of bifurcating groundwater from the land ACs from Site-related groundwater at the Site is that evaluation of feasible remedial action alternatives for the three land ACs is progressing without the benefit of even a final RI Report for Site-Related Groundwater. As USEPA is aware, at the direction of USEPA over the objection of Ford and the Borough, the RI and FS Reports for the three land ACs were originally drafted and submitted without the benefit of a final Site-Related Groundwater RI Report. Since the RI for groundwater progressed throughout 2012, the RI reports for the three land ACs have been updated and revised to include supplemental groundwater and surface water quality data generated by the Supplemental RI Workplan for Site-related groundwater. These Revised RI Reports were submitted in December 2012 but the record will still show that the FS for the three land ACs were prepared and reviewed by the agencies before a final Site-Related Groundwater RI Report was completed.

Early on, and on several occasions during meetings with the agencies, representatives of the CAG raised concerns regarding separation of groundwater at the Site into a separate AC because of concern regarding the Wanaque Reservoir located approximately one mile downgradient of the Site. The Wanaque is a source of drinking water not only for residents of the Borough but also serves as a drinking water source for millions of New Jersey residents. To address and mitigate this concern, the environmental consultants for Ford and the Borough (ARCADIS and EXCEL, respectively) have utilized existing groundwater data generated during the RI for each of the three land ACs and the 2012 Supplemental RI for Site-related groundwater to evaluate whether or not any of the three land ACs has, or has the future potential to, adversely impact groundwater quality and whether or not the Wanaque Reservoir or the Boroughs municipal drinking water supply wells, are at risk of being adversely impacted.

Over 30+ years of groundwater data have been generated at the Site with an extensive investigation of groundwater and surface water flow and quality conducted by Ford over the course of the previous and recent Superfund investigations. These data exist for the individual land ACs as well as for the areas downgradient towards the Reservoir. These groundwater data were therefore utilized during the evaluation of remedial action alternatives detailed in the Draft FS Reports that were generated by ARCADIS in collaboration with EXCEL.

6.0 OVERVIEW OF SITE-RELATED GROUNDWATER RI FINDINGS

The purpose of the Draft Site-Related Groundwater RI Report prepared in January 2013 is to summarize the findings of the site-wide investigation and characterization of geology and hydrogeology at the Site, including groundwater and surface water occurrence, movement, and quality as well as the occurrence, distribution, fate and transport of any constituents of concern reported above an applicable groundwater or surface water quality standard to determine whether or not there is any actual or potential risk associated with any constituents of concern with respect to public health or the environment. It presents and discusses the empirical data generated from the comprehensive, in-depth and multi-faceted RI so that Ford and the Borough can effectively address questions and issues that have been raised over the course of the RI by the Agencies, the Community Action Group, and the public as documented in various letters, memoranda, and as discussed in meetings.

The findings of the comprehensive, in-depth groundwater and surface water investigation conducted as part of the 2012 Supplemental RI were used in conjunction with the results of the RI conducted for each of the three land ACs to develop a site-wide Conceptual Site Model for the Site to visually reflect the overall findings of the RI for all four of the ACs and enhance the meaningfulness of the conclusions outlined in the RI Report. The Conceptual Site Model for the Site prepared by ARCADIS as part of the Draft Site-Related Groundwater RI Report (Arcadis Figure 34) is attached.

Over a 16-year period from 1984 through 2000, Ford conducted a site-wide RI for groundwater and surface water that included collection and laboratory analysis of 281 groundwater and 56 surface water samples. As part of the RI, a total of 24 groundwater monitoring wells were installed and 11 surface water sampling stations were established upgradient and downgradient of areas where paint sludge had been removed. Following paint sludge removal activities and the RI of soil, surface water and groundwater conducted by Ford from 1984 through 2000, in 2002, USEPA concluded, and NJDEP concurred, that the post-remediation 5-year Environmental Monitoring Program (EMP) conducted by Ford was complete at the Site based on the analytical results generated from 1984 through 2000 and the fact that all residents at the Site were supplied with drinking water from the municipality. At that time, USEPA also noted that the North Jersey Water Supply District reported no concerns regarding the Wanaque Reservoir.

After the AOC was issued in 2005 and the Site was re-listed to the NPL, a site-wide investigation and characterization of groundwater and surface water was a required component of the work scope that Ford was required to implement at the Site. This comprehensive, in-depth, and multi-faceted RI for groundwater and surface water included:

- Groundwater sampling on a semi-annual basis from 2006 through 2009 and on an annual basis from 2010 through 2012 with a total of 70 additional groundwater samples collected from 29 overburden wells and 28 bedrock wells with depths ranging from 10 to 462 ft bgs;
- Sampling and analysis of groundwater from the PMP Air Shaft from 2006 through 2012 and from the CMP Shaft in 2012;
- Sampling and analysis of sediment from the base of the PMP Air Shaft;
- Analysis of all groundwater samples for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, pesticides and polychlorinated biphenyls (PCBs);
- Surface water sampling between 2005 and 2012 to supplement results of prior surface water sampling performed from 1984 through 2004 with samples collected at 14 locations in Mine Brook, North Brook, Park Brook and Peters Mine Brook, several seeps, and the PMP pond;
- 10 sediment samples were collected during the first surface water sampling event co-located with the surface water samples. An additional six sediment samples were collected from the PMP pond in May

2011. All surface water and sediment samples were analyzed for VOCs, SVOCs, metals, pesticides, and PCBs;

- Down-hole geophysical logging and packer testing of bedrock boreholes;
 - Surface water gauging, including installation of permanent staff gauges;
 - Bedrock fracture orientation measurements;
 - Major cation/anion sampling and analyses in 2006 and 2012
 - Geochemical analyses of groundwater and surface water samples;
 - Environmental tracer, stable and radioactive isotope data collection and evaluation
 - Groundwater level and pressure transducer installation and evaluation;
 - Flow meter installation and monitoring within the PMP Air Shaft and CMP Shaft; and
 - Compound-Specific Isotope Analysis (CSIA) and Bio-trap® installation for evaluation of benzene biodegradation
- The Site-wide Conceptual Site Model illustrates the minimal bedrock flow in deep bedrock, the upward movement of groundwater from deeper to shallower bedrock and the overburden and the discharge of groundwater from the overburden and shallow bedrock to the surface water streams that flow from the PMP Area, past the OCDA and CMP, to the Ringwood Creek and eventually to the Wanaque Reservoir located more than a mile from the PMP Area.
- ❖ This groundwater to surface water pathway is has been verified by the multiple lines of technical evidence generated during the 2012 Supplemental RI for groundwater and surface water at the Site and is an integral component of the Conceptual Site Model for the Site and for each of the 3 land ACs.
- As shown in the PMP Area Conceptual Site Model (Arcadis Figure 33 from the Draft Site-Related Groundwater RI Report), the PMP Air Shaft is completed to a depth of approximately of 232 feet bgs where it intersects a mine incline shaft that runs upward to the PMP. The data generated during the RI indicate that both the PMP and the PMP Air Shaft are in hydraulic communication with the underground workings that extend to total depths of approximately 1,700 ft bgs as shown in the Conceptual Site Model and that these mine workings effectively function as a groundwater “storage” feature.
- Although there are no constituents of concern associated with groundwater within the CMP Area other than sporadic detections of total lead, a Conceptual Site Model for the Cannon Mine Pit Area has also been prepared and is attached (Arcadis Figure 28 from the Draft Site-Related Groundwater RI Report). As shown, the CMP Mine Shaft extends to a depth of approximately 500 ft bgs. The data generated during the RI indicate that there is some hydraulic communication between the CMP Area and the CMP Mine Shaft although it is not as significant as that documented in the PMP Area.

Summary and Conclusions

- 🚧 There are limited constituents of concern in groundwater and fewer still in surface water, including benzene and to a lesser extent total lead and total arsenic, and the occurrence of any of the constituents of concern is limited in extent to the immediate vicinity of one or more of the three land ACs with no indication of migration to or beyond Site boundaries.
- 🚧 Delineation of constituents of concern in groundwater and surface water, including their occurrence, distribution, fate and transport, has been completed, along with an in-depth, multi-faceted investigation of

the occurrence, movement, and “connectivity” of groundwater in the crystalline bedrock, the overburden and the surface waters at the Site.

- ✚ As shown in the Site-wide Conceptual Site Model and the PMP Conceptual Site Model, the results of the RI show that groundwater in bedrock in the vicinity of the PMP Area has an upward vertical component which indicates hydraulic communication between the deeper bedrock and mine workings, the shallow bedrock and the overlying overburden aquifer whereby older bedrock groundwater is mixing with younger, shallower bedrock groundwater and ultimately with younger overburden groundwater.
- ✚ In turn, overburden groundwater mixed to some extent with bedrock groundwater is ultimately discharging to the surface water streams at the Site which meander across the Site for miles prior to ultimately discharging to the Ringwood Creek and eventually to the Wanaque Reservoir.
- ✚ The occurrence and distribution of the constituents of concern in groundwater and/or surface water at the Site is extremely limited because of:
 - The comparatively low to trace starting concentrations in the source areas;
 - The limited occurrence and tortuous movement of groundwater through fractures in the crystalline bedrock; and
 - The documented natural attenuation mechanisms which are occurring under existing conditions at the Site, including:
 - ❖ Adsorption, dispersion, and natural oxidation/reduction processes for removal of trace lead and arsenic concentrations;
 - ❖ A statistically significant decreasing trend for benzene concentrations at key PMP Area wells coupled with the irrefutable evidence of natural microbial degradation of residual benzene concentrations in the PMP Area, including the Air Shaft, as evidenced by the CSIA and Bio-Trap® results which are accepted by experts and agencies worldwide as the gold standard for proof that biodegradation is occurring.
- ✚ To a minimal extent, groundwater within the PMP Air Shaft is in hydraulic communication with the deeper bedrock and mine workings but the data generated by the state-of-the art investigative techniques utilized for completion of this RI, including stable and radioactive isotope, major cation/anion, chlorofluorocarbon, radon, pressure transducer and flow meter evaluations indicates that there is limited, if any, lateral hydraulic communication with groundwater at adjacent and downgradient overburden and well locations with the possible exception of bedrock wells RW-5 and RW-6/6A.
- ✚ The RI data indicate a residual source of benzene at the base of the PMP Air Shaft which may be associated with trace concentrations in sediments at the base of the Shaft or potentially reflective of the deeper mine workings but, regardless of origin, under existing pre-remediation conditions, the empirical data and irrefutable CSIA and Bio-Trap® results show that the residual benzene mass is being effectively controlled within the Air Shaft via natural aerobic, and to a lesser extent, anaerobic microbial degradation as was previously postulated by the Technical Advisor to the CAG.
 - The data indicate that no additional investigation of the PMP Air Shaft or PMP Area hydrogeology, geochemistry or microbiology is warranted given that the occurrence and distribution of the residual concentrations is well documented, the levels remain comparatively low, and are isolated with very

limited, if any, lateral migration in groundwater within the PMP and no migration beyond the PMP to the downgradient areas of the Site.

- The annual groundwater and surface water monitoring that has been conducted during the RI, including potentially enhancing the existing surface water monitoring program to further supplement the data generated to date would continue as part of any remedy selected for the ACs and should therefore proceed for further verification of the RI findings but these data are not expected to alter the overall conclusions outlined in the Draft Site-Related Groundwater RI Report dated January 2013.
- ✚ Groundwater in the vicinity of the CMP is not directly in hydraulic communication with deeper groundwater in the bedrock to the extent documented in the PMP Area but, like the PMP Area, the overburden and bedrock monitoring well network is thorough and effective.
- ✚ There is no indication of any actual or potential adverse impact nor any risk to the quality of water within the Wanaque Reservoir or the Borough of Ringwood Municipal Drinking water wells that are located farther east and southeast of the Wanaque which is consistent with the conclusions originally drawn by USEPA and NJDEP at the completion of the initial RI in 2001/2002.
- ✚ Continued groundwater monitoring as part of a Monitored Natural Attenuation (MNA) Program under a Classification Exception Area (CEA) is appropriate for the PMP Area, including the Air Shaft, and the OCDA and CMP Areas at locations where one or more constituents of concern exceed their respective GWQS, other than the secondary metals (i.e. aluminum, iron, manganese, sodium, etc.) for which a CEA is not warranted under NJ regulations.
- ✚ Sufficient data has been collected and comprehensive evaluation of that data performed to complete the investigative phase of the RI of groundwater and surface water at the Site such that these data and their findings can be used to support remedial action decision making for the 3 land ACs and for Site-related groundwater at the Ringwood Mines/Landfill Site.

As previously outlined in the Borough's May 18, 2012 paper entitled "Overview of the Site Conditions and Feasible Remedial Action Alternatives for Protection of Human Health and the Environment at the Ringwood Mines/Landfill Superfund Site", the following briefly summarizes conditions within each of the 3 land ACs with an emphasis on how these conditions relate to the findings of the Site-Related Groundwater RI.

Peters Mine Pit:

- The Peters Mine Pit is approximately 460 feet long by 200 feet wide and averages approximately 55 feet deep with a maximum depth of approximately 92 feet. The Peters Mine Pit Area is approximately 3 acres in size. A generalized Cross-Section of the Pit area taken from the Revised RI Report (Arcadis Figure 6) is attached for reference to illustrate the configuration of this historic mining feature.
- There is a shallow pond on the surface of a portion of the Pit that was created when materials within the Pit subsided after the Pit was filled and covered with soil many years ago. The results of the RI indicate that the pond is an expression of the shallow water table.
- Soil and fill material within the Pit exhibits sporadic and generally very low concentrations of various constituents, including metals, polyaromatic hydrocarbons (PAHs), volatile organic compounds (VOCs) including benzene, ethylbenzene, toluene, and xylenes (BTEX) and polychlorinated biphenyls (PCBs)

with no pattern exhibited by the distribution and concentrations that meet the definition of “Low Level Threat Waste” and which do not rise to the level associated with “Principal Threat Waste” (USEPA, 1991).

- As shown in the attached Cross-Section, occasional subgrade pockets of paint sludge were encountered in borings conducted within the Pit, however, the data from the RI indicates these paint sludge accumulations are sporadic and not significant in size. Paint sludge does not occur at the ground surface within the Peters Mine Pit Area or in the shallower fill material surrounding the pond.
- The constituents reported in the fill materials pose a potential risk to human health and the environment via the direct contact/ingestion/inhalation pathway therefore remedial action is warranted to address the risk posed by the direct contact pathway.
- The PAHs, PCBs and metals reported in the fill material generally have a strong affinity for sorption to soil and other organic matter in the subsurface and are generally not highly soluble in water. Although more soluble in water, the concentrations of BTEX reported in the fill are sporadic and, although some exceed soil remediation standards, the exceedances are generally slight.
- Groundwater quality within the Peters Mine Pit verifies the aforementioned findings with respect to the absence of any organic constituents at concentrations above their respective GWQS other than low levels (generally single digit) of benzene slightly above its GWQS of 1 ug/L at monitoring well SC-01 is located within the Pit itself. Analytical data from well SC-01 has indicated no adverse impact to groundwater with respect to any of the PAHs or PCBs with only benzene reported at levels just slightly above its 1 ug/L standard.
- Not surprisingly, the naturally-occurring metals that are abundant at this former Iron ore mine based on the native bedrock mineralogy, most notably iron and manganese, are reported in groundwater at concentrations which are elevated in comparison to background levels due to the absence of dissolved oxygen (i.e. reducing geochemical conditions) likely driven by oxidation of the organic matter within the Pit--- wood, tree limbs, leaves, etc.
 - ❖ These reducing groundwater conditions result in higher iron and manganese levels than background levels which return to within the range of natural background as groundwater flows downgradient from the immediate Peters Mine Pit Area where oxygen levels in groundwater are replenished and iron and manganese in the groundwater precipitate as solids.
- Groundwater quality immediately downgradient of the Pit indicates residual benzene concentrations that generally range from 5 to 6.5 ug/L in shallow overburden and bedrock wells, however, the concentrations dissipate downgradient and benzene is not detected downgradient.
- A concentration of benzene that has fluctuated but remains, on average, approximately 28.5 ug/L has been reported in groundwater at the base of the Peters Mine Air Shaft located approximately 50 feet east of the Peters Mine Pit. The base of the Air Shaft at 230 feet is approximately 130 feet deeper than the base of the Pit and both are within the native crystalline bedrock.
 - Data from the RI had indicated that the water at the base of the Air Shaft is stagnant and the benzene is not migrating beyond the Shaft as evidenced by bedrock wells installed immediately adjacent to the shaft where benzene has never been detected over the past two years of monitoring.
 - Results of the Supplemental RI conducted in 2012 indicate that there is some, but very minimal, flow within the Air Shaft and that, from the base of the shaft to the shallower depths within the

shaft, benzene concentrations dissipate to below detection and there is no movement of benzene at concentrations of concern beyond the immediate vicinity of the shaft as confirmed by groundwater analytical results in downgradient monitoring wells.

- Delineation of the benzene has been completed based on analytical results from the existing network of overburden and bedrock wells.
- Benzene has not been detected in the surface water, other than at low levels at seep locations that do not directly discharge to the streams, nor in sediment of the adjacent Park Brook nor in surface waters downstream of the Peters Mine Pit therefore, although the groundwater flow pathway is ultimately to the surface waters, there is no transport of benzene at concentrations of concern and no human health or ecological risk posed by the concentrations of benzene in groundwater in the vicinity of the Peters Mine Pit.
- Additional overburden and bedrock wells exist further downgradient of the Peters Mine Pit Area that serve as an additional layer of “sentinel wells” (i.e. wells located sufficiently downgradient of an area of concern and sufficiently upgradient of a potential receptor to serve as an “advance warning signal”) have consistently been clean.
- These “sentinel wells” would be included in the post-remediation groundwater monitoring program included in the scope of both the excavation/disposal and Engineered Cap alternatives. Although not anticipated, data from these wells would provide an advance indication of any change in groundwater conditions that could potentially threaten surface water quality, including the Wanaque Reservoir, or the municipal drinking water wells located to the east of the Reservoir.
- A 30-year post-remediation groundwater monitoring program which includes annual sampling of these “sentinel wells” was included in the remedial action cost estimates for excavation/disposal and Engineered Cap construction as detailed in the FS Report for the Peters Mine Pit.

Cannon Mine Pit:

- The Cannon Mine Pit is approximately 190 feet x 300 feet and a maximum of 60 feet deep and approximately 1.5 acres in size. A generalized Cross-Section of the Pit Area taken from the RI Report (Arcadis Figure 3) is attached for reference to illustrate the configuration of this historic mining feature.
- The results of the RI indicate that surface soil is clean with no exceedances of applicable direct contact soil remediation standards.
- Sporadic, infrequent, and generally low concentrations of various constituents, including metals, PAHs, VOCs, and PCBs have been reported within the soil/fill material within the Pit with no pattern exhibited by the distribution. Concentrations are consistent with the definition of Low Level Threat Waste and do not rise to the level associated with Principal Threat Waste.
- Note that the concentrations of iron or manganese or any of the other naturally-occurring secondary metals are consistent with upgradient background concentrations and are not elevated because groundwater geochemical conditions in the vicinity of the Cannon Mine exhibit oxygen concentrations typical of background levels and these metals are not as soluble under oxidizing conditions as they are under the localized reducing conditions that exist in the immediate vicinity of the Peters Mine Pit or the O'Connor Disposal Area.

- As shown in the Cross-Section, several drums were encountered within the Pit that will be removed by Ford under any of the remedial action alternatives that would be considered for implementation at the Site. No paint sludge has ever been found within the Pit or on the surface of the Cannon Mine.
- The constituents reported within the fill materials pose a potential risk to human health and the environment via the direct contact/ingestion/inhalation pathway therefore remedial action is warranted to address the risk posed by the direct contact pathway.
- Groundwater is not encountered within the Pit at depths that correlate to the soil/fill material but it occurs at depth at the base of the fill near the fill/mine tailings interface.
- Groundwater quality within and immediately downgradient of the Pit indicates no impact to groundwater associated with the Pit, specifically no indication of any organic or inorganic constituents other than various metals, including iron and manganese, at concentrations above background.
- Groundwater analytical results from sampling of the Cannon Mine Shaft conducted in 2012 confirm no VOC, PAH, or PCB constituents of concern and only the same naturally-occurring metals that are indicative of the native crystalline bedrock as exhibited in groundwater at wells located upgradient and downgradient of the various land ACs.
- Given that there is no adverse impact to groundwater associated with the Cannon Mine, there is no actual or potential risk to surface water quality in this area and groundwater poses no human or ecological risk.
- Additional overburden and bedrock wells existing further downgradient of the Cannon Mine Pit that serve as an additional layer of “sentinel wells” (i.e. wells located sufficiently downgradient of an area of concern and sufficiently upgradient of a potential receptor to serve as an “advance warning signal”) have consistently been clean.
- These “sentinel wells” would be included in the post-remediation groundwater monitoring program included in the scope of both the excavation/disposal and Engineered Cap alternatives. Although not anticipated, data from these wells would provide an advance indication of any change in groundwater conditions that could potentially threaten surface water quality, including the Wanaque Reservoir, or the municipal drinking water wells located to the east of the Reservoir.
- A 30-year post-remediation groundwater monitoring program which includes annual sampling of these “sentinel wells” was included in the remedial action cost estimates for excavation/disposal and Engineered Cap construction as detailed in the FS Report for Cannon.

O’Connor Disposal Area:

- The O’Connor Disposal Area is approximately 12 acres in size and is located on an existing slope located immediately adjacent to the southeastern side of Peters Mine Road as shown on Figure 1. A generalized cross-section of the O’Connor Disposal Area taken from the RI Report (Arcadis Figure 8) is attached to illustrate that this area is located on a slope that extends from Park Brook up to the edge of Peters Mine Road.
- Groundwater is encountered at varying depths below grade but is generally encountered at the base of the soil/fill material approximately 8 to 10 feet deep.
- Soil and fill material within the O’Connor Disposal Area exhibits sporadic and generally very low concentrations of various constituents, including metals, PAHs, VOCs including varying but generally

low levels of BTEX and PCBs. No pattern exhibited by the distribution and concentrations rise to the level associated with Principal Threat Waste.

- As discussed in the RI Report for this area, occasional subgrade pockets and flows of paint sludge were historically encountered in borings conducted within this Area and Ford subsequently excavated and transported for offsite disposal approximately 2,200 tons of paint sludge. Based on soil borings and extensive test pit activities within the O'Connor Disposal Area, the data indicate that chunks and chips of paint sludge are sporadically encountered; however, there is no indication of an adverse impact to soil quality that can be correlated with the occurrence of these chunks or chips.
- The constituents reported in the fill materials pose a potential risk to human health and the environment via the direct contact/ingestion/inhalation pathway therefore remedial action is warranted to address the risk posed by the direct contact pathway.
- The PAHs, PCBs and metals reported in the fill material have a strong affinity for sorption to soil and other organic matter in the subsurface and are generally not highly soluble in water. Although more soluble in water, the concentrations of BTEX reported in the fill are sporadic and, although some exceed soil remediation standards, the exceedances are generally slight.
- Groundwater quality within and immediately downgradient of the O'Connor Disposal Area indicates no impact to groundwater in this area, specifically no indication of any of the PAH, VOC, and PCB constituents reported sporadically in the fill material and only various concentrations of metals, including iron, manganese and occasionally arsenic that are naturally abundant in the native bedrock, at concentrations above background.
 - ❖ Elevated concentrations of iron and manganese and the occasional reporting of arsenic slightly above its 8 ug/L GWQS are due to the reducing groundwater conditions caused by oxidation of the organic matter within the fill but, in many instances, are also reflective of elevated suspended particulates, or turbidity, in groundwater samples collected during the RI. The concentrations of these metals return to within the range of natural background as groundwater flows beyond the immediate area and oxygen levels in groundwater are replenished. Under these geochemical conditions, iron, manganese, and any trace arsenic in groundwater will precipitate as solids.
- Given that there is no adverse impact to groundwater associated with the O'Connor Disposal Area, there is no actual or potential risk to surface water quality in this area and groundwater poses no human or ecological risk.
- Despite the findings of the RI that indicate that groundwater quality has been characterized and there is no adverse impact or risk associated with it, additional downgradient wells have been installed at the request of the agencies to further verify groundwater quality downgradient of this Area between the O'Connor Disposal Area and Sally's Pond located approximately 1,000 feet to the east.
- Additional overburden and bedrock wells existing further downgradient of the Cannon Mine Pit that serve as an additional layer of "sentinel wells" (i.e. wells located sufficiently downgradient of an area of concern and sufficiently upgradient of a potential receptor to serve as an "advance warning signal") have consistently been clean.
- These "sentinel wells" would be included in the post-remediation groundwater monitoring program included in the scope of both the excavation/disposal and Engineered Cap alternatives. Although not anticipated, data from these wells would provide an advance indication of any change in groundwater conditions that could potentially threaten surface water quality, including the Wanaque Reservoir, or the municipal drinking water wells located to the east of the Reservoir as shown in Figure 1.

- A 30-year post-remediation groundwater monitoring program which includes annual sampling of these “sentinel wells” was included in the remedial action cost estimates for excavation/disposal and Engineered Cap construction as detailed in the FS Report for the O’Connor Disposal Area.

7.0 SUMMARY OF KEY OBSERVATIONS

In summary, the following key observations are made by the Borough for consideration by the USEPA NRRB:

- There are more than 30+ years of groundwater analytical data generated over the course of the two phases of investigation supplemented by the recent Supplemental RI conducted in 2012 which creates a long-term analytical database from which to evaluate historic and existing concentration trends and reliably predict future behavior of constituents reported in groundwater at the Site.
- The multi-faceted and long-term database supports the conclusion that the conditions at the Site, including in the immediate vicinity of the Peters Mine Pit where the only adverse impact to groundwater has been documented, are stable and essentially in steady state meaning that there has been no notable changes in groundwater quality over the course of monitoring other than decreases in benzene concentrations at wells located within and downgradient of the Peters Mine Pit.
- These steady state groundwater conditions enable the reliable future prediction of groundwater quality in the future.
- With current pre-remediation conditions indicating no appreciable adverse impact to groundwater in any of the three land ACs or anywhere else at the Site, evaluation of feasible remedial action alternatives must carefully consider the potential risk of any adverse impact or degradation of groundwater quality resulting from the implementation of any remedy given that the risk of any such adverse impact exceeds any actual human health or ecological risk posed by groundwater under existing pre-remediation conditions.
 - Specifically, disruption of pit materials below the water table in Peters Mine and Cannon Mine Pits will likely cause releases of constituents into shallow and/or deep groundwater that are currently stable and not causing an adverse impact to groundwater under existing, pre-remediation conditions.
 - It is not possible to accurately/reliably predict the future risk that disruption will worsen groundwater conditions which under pre-remediation conditions are in steady state with minimal benzene concentrations that are not migrating or impacting any human or ecological receptor.
- The evaluation of feasible remedial action alternatives must also carefully consider the physical risks associated with intrusive remedial action alternatives given the long mining history of the Site and the fact that two of the three land ACs (specifically the Peters Mine Pit and the Cannon Mine Pit Areas) were actual mines and historic mine structures and subsurface appurtenances likely remain associated with them.
 - Notably, the width and depth of the Peters Mine Pit poses significant challenges with respect to safely and effectively reaching fill material for removal without placing the safety of workers at extreme risk; and
 - Excavation of subgrade materials adjacent to Peters Mine Road within the O’Connor Disposal Area would leave the area at a significantly lower elevation and could cause instability along

the roadway given that any excavation would extend to depths greater than 15 feet bgs immediately adjacent to a significant length of the roadway.

- Groundwater is not used at or in the vicinity of the Site and drinking water is supplied to the residents of the Borough from either the Wanaque Reservoir or from one of six municipal production wells located several miles east of the Site on the eastern side of the Reservoir.
- The results of the Supplemental groundwater and surface water RI and the risk assessments for each land AC confirm that neither the Wanaque Reservoir nor the municipal production wells are at risk of any adverse impact associated with groundwater or surface water quality at the Site and the existing network of overburden and bedrock monitoring wells, including “sentinel wells”, will be monitored for many years as part of the remedies being considered by USEPA for this Site.
- As previously stated, the remedial action cost estimates for both the Engineering/Institutional Control and Excavation/Disposal categories of remedies included in each of the FS Reports includes 30-years of post-remediation groundwater monitoring for each of the three land ACs and their associated “sentinel wells”.
- As previously stated in the Borough’s May 2012 NRRB submission, both the Engineering/Institutional Control and Excavation/Disposal alternatives are protective of human health, the environment, the community and its residents based on the only documented risk which is via direct contact/ingestion/inhalation with soil/fill materials within each of the three ACs.
- The Excavation/Disposal remedy has the potential to create risks that do not currently exist at the Site, including physical hazards, odor and dust generation associated with excavation and transportation of waste materials through the community, wear and tear on existing roads, the potential for destabilization of Peters Mine Road (O’Connor Disposal Area only), and physical hazards to workers associated with the depth of excavation within the Pits and the steep slopes within the O’Connor Disposal Area whereas these risks, although present, are significantly less if Engineered Caps are the selected remedy
- Given that both remedies remove the direct contact/ingestion/inhalation risk, there is no adverse impact to groundwater associated with the Cannon Mine Pit or the O’Connor Disposal Area and only minimal benzene concentrations remaining in the immediate vicinity of the Peters Mine Pit with no benzene mass discharge from the Pit itself as confirmed during the Supplemental RI conducted in 2012, there is no Principal Threat Waste within any of the three land ACs, and the use of an Engineered Cap with Institutional Controls is the presumptive remedy for land disposal areas with only Low Level Threat Waste, the data indicate that selection of a remedy other than the use of Engineering and Institutional Controls is not technically justified or appropriate for the documented risks
- Construction of Engineered Caps can be implemented and completed in a shorter timeframe and with significantly less disruption/disturbance to both Upper and Lower Ringwood, significantly less risk of adversely affecting groundwater or surface water quality during or after construction activities, and with significantly less risk to residents, the existing infrastructure, the community as a whole, and to workers implementing the remedy in each of the three land ACs.

8.0 REFERENCES

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ARCADIS, U.S., Inc., January 2012a. Revised Screening Level Ecological Risk Assessment for the Peters Mine Pit Area, Ringwood Mines/Landfill Site, Ringwood, New Jersey.

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